

Software Controlled Experimental Radar (IMRADX-07-10)

Versatile experimental radar for near range imaging of buried targets is now available. The near range imaging can be performed using both time domain and frequency domain systems. In both the systems, the principle is to obtain the scattering response of the target when illuminated by a wide range of resultant time domain signals are analyzed either by FDTD method or frequency domain scattering method. In frequency domain technique, the target is illuminated by a set of discrete frequencies (with defined instantaneous bandwidth) and the scattered signal parameters are recorded. The frequency domain system is similar to what is used in a network analyzer, where the transfer parameters of the scattered signal are measured. The frequency domain technique generally provides better SNR and is rather easily performed. The radars can be operated in monostatic or bistatic modes. They can have fixed locations or can have different viewing angles. With multiple viewing angles, the tomographic analysis is possible.

FREQUENCY STEPPED RADAR: ISSUES:

- Monostatic: Require pulsed operation resulting large instantaneous bandwidth
- Bistatic: Can use pure CW enabling better SNR at the cost of conventional ranging. Range information can be recovered from frequency domain processing
- Pulsing: Range resolution, bandwidth, Tx, Rx isolation, T/R switch

- Polarization:
 - ⊕ $T_{11} R_{11}, T_{11} R_1, T_1 R_{11}, T_1 R_1$
 - ⊕ All combinations or two?
- Dynamic Range:
 - ⊕ Tx, Rx isolation, clutter to signal ratio
 - ⊕ 40 to 70 dB typical
- Calibration Scheme: Amplitude, phase accuracies
- Power: 50 to 100 watts
- Frequency coverage: 300 MHz to 2 GHz
- Frequency step: 10 KHz or more (not critical)
- Frequency switching time: 1 ms or less
- Frequency table: 500 or more
- Frequency step-chirp: Pulse to pulse, sequential or pseudorandom
- Phase code: BPSK
- Waveform flexibility: CW, Frequency sweep, pulse width
- Antenna type: Horn, Vivaldi
- Transmit pulsewidth: 20 ns to CW in steps of 10 ns
- Instantaneous bandwidth: 10 Hz, 50 MHz, 100 MHz
- Selectable Video BW: 10 Hz, 50 MHz to 200 MHz in 10 MHz steps
- PRF / sample rates: CW, 100 μ secs to 1 μ secs
- Range sampling jitter: < 10 ps
- ADC quantization: 12, 16, or 24 bits
- Dynamic range: 50, 70 to 100 dB